Strip clustering in PandoraPFA

Daniel Jeans
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introduction
quick sketch of strip clustering
combination with PandoraPFA
first preliminary results

Introduction

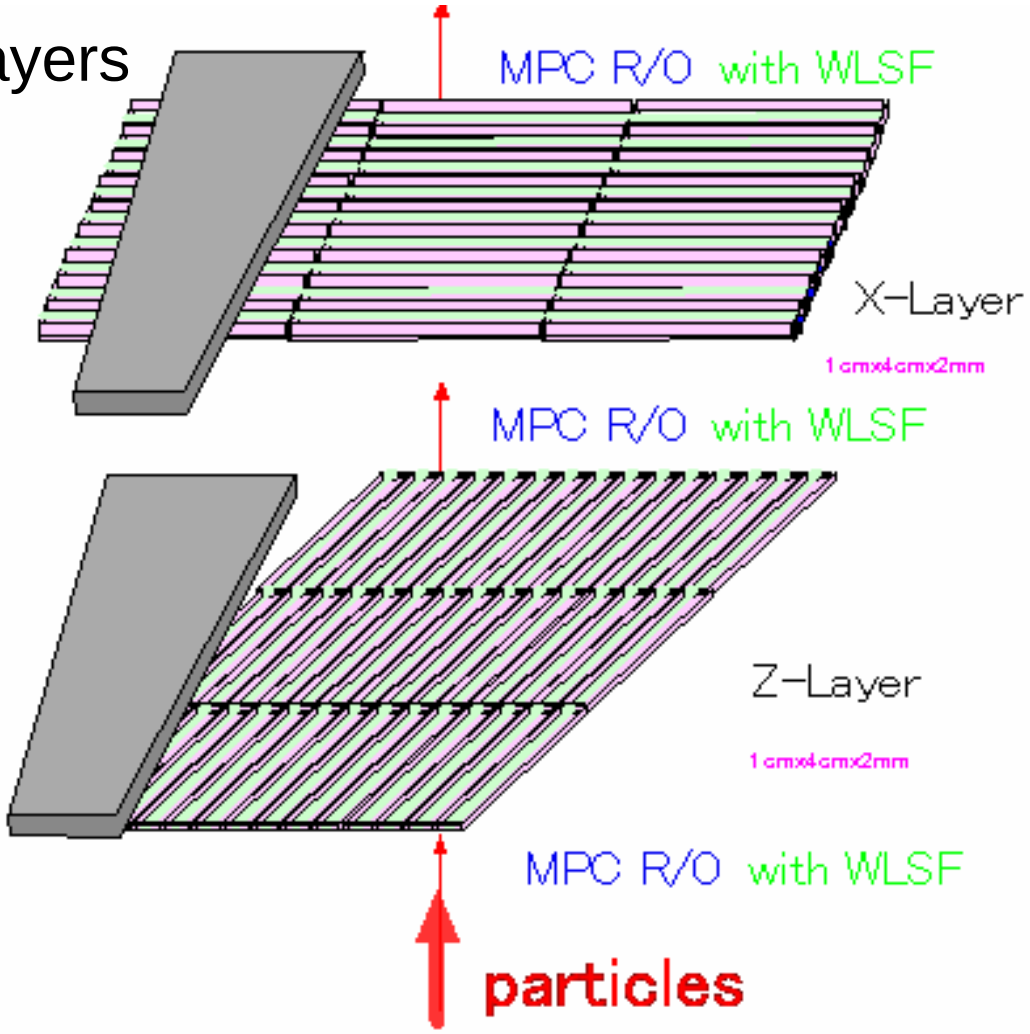
Developing clustering algorithm for strip-based calorimeter

e.g. Calorimeter with scintillator strip active layer

perpendicular strips in adjacent layers

for strip size of *e.g.* 1x4cm^2,
hope to get better performance
than 2x2cm^2 (equal area),
closer to 1x1cm^2

optimise # readout channels &
photon sensors (~cost)
vs. performance



Previously had strip clustering implemented in specific PFA algorithm

performance of this algorithm << Pandora PFA

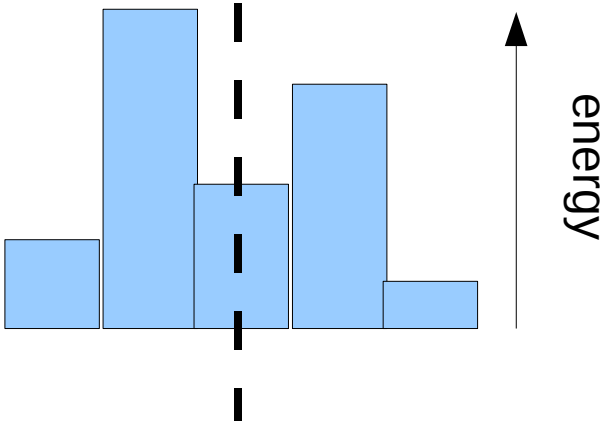
deconvolute strip clustering & PFA, switch to PandoraPFA
- saves effort in PFA development
- allow more robust comparisons

now have a first, rather rough implementation
- first run strip clustering algorithm
- pass results to PandoraPFA

Sketch of strip clustering algorithm

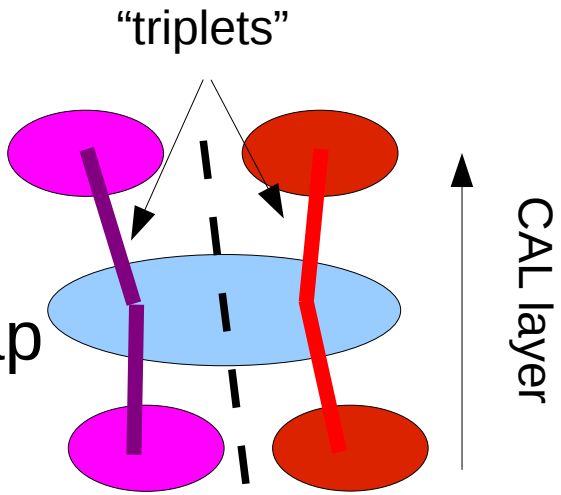
make “2-d” clusters within each layer

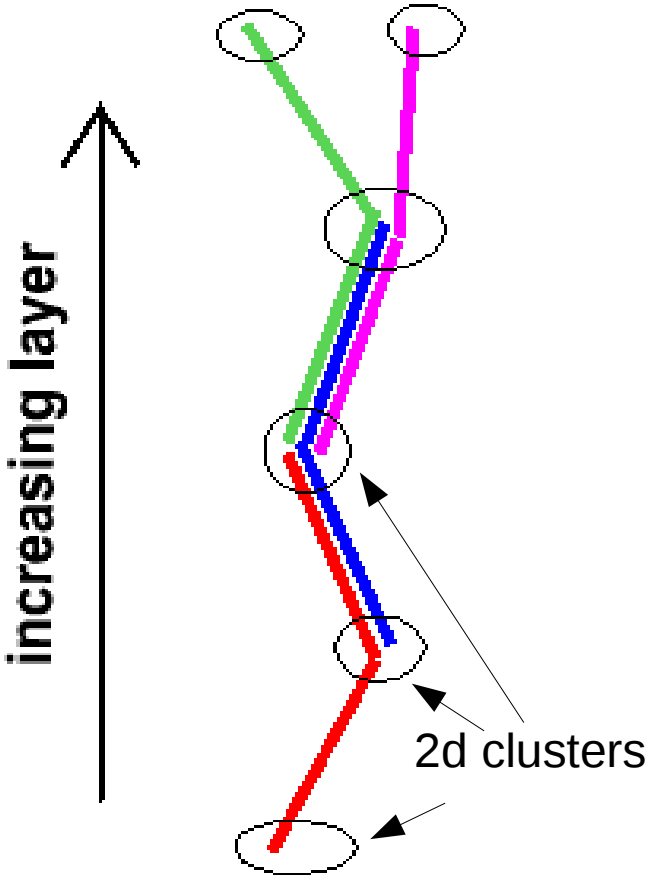
check for sub-structure: split if appropriate



combine 2-d clusters with clusters in
adjoining layers -> “triplets” of clusters

if cluster shared by several “triplets”, split it
important for strip geometry
define figure-of-merit for triplet: cluster overlap





now have collection of triplets

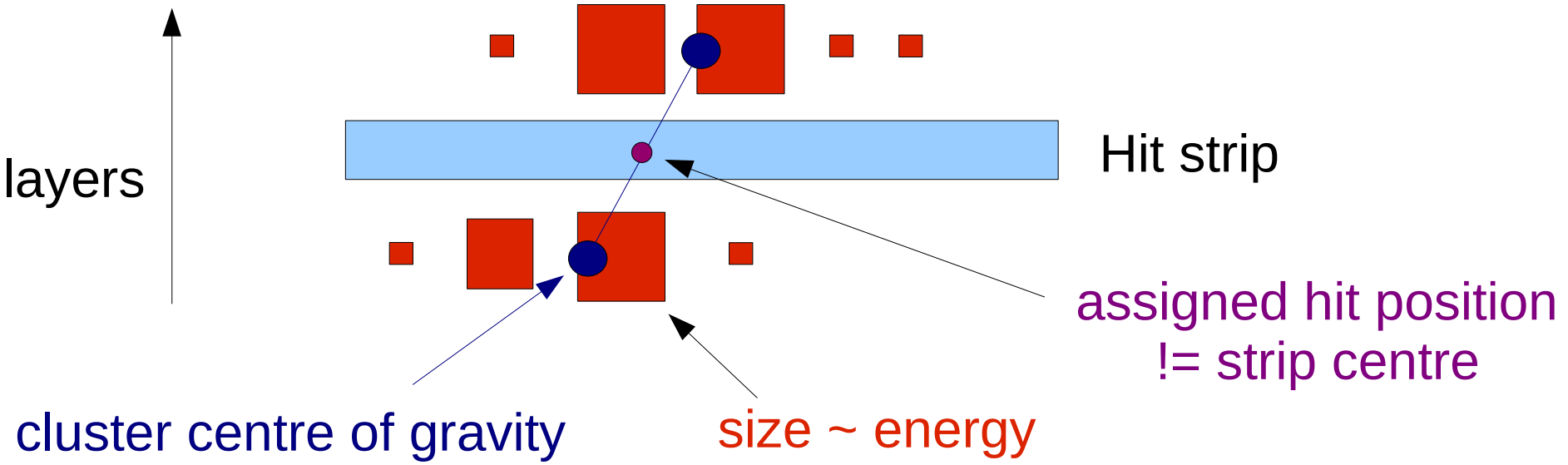
starting from inner ECAL, combine
overlapping triplets -> 3d clusters
use triplet figure-of-merit when faced
by several possibilities

~ “tracking” in CALO

it's also helpful to seed clustering
with tracks from tracking detector
- helps resolve some ambiguities
this part not yet combined with PandoraPFA

Strip clustering -> PandoraPFA

Inside 3d cluster, for each hit look at position of energy deposits in neighbouring layers, choose “best-guess” position for hit



then pass these new hit positions (with original energy) to PandoraPFA

Look at e+e- -> qq events (q = u, d, s)

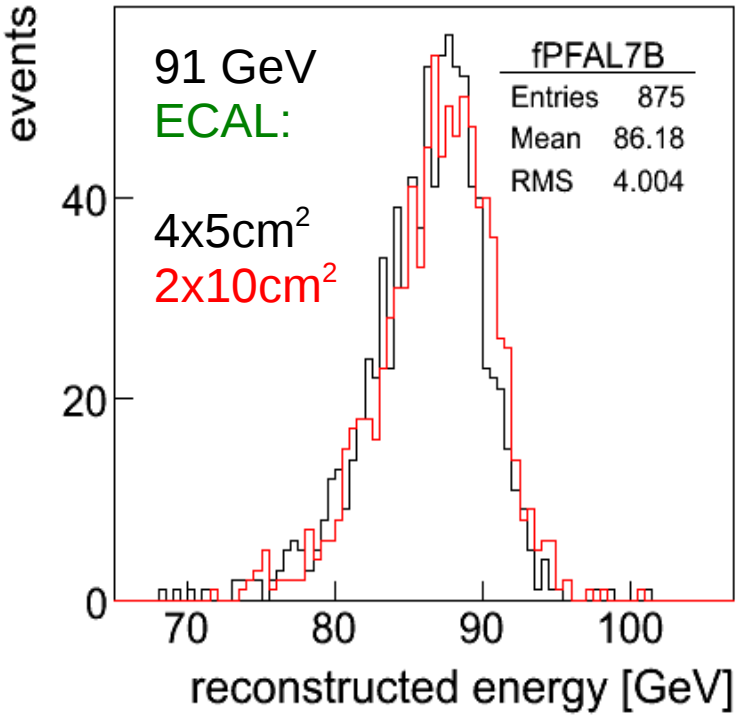
centre-of-mass energy = 91 & 200 GeV

- different energy jets, different jet boosts, different confusion term

events fully simulated in Jupiter framework,

reconstructed by MarlinReco,

PandoraPFA v2-00



look at central jets (|cosθ| < 0.7)

measure PFA performance using

RMS90 estimator.

Consider various detector geometries:

GLD (apr '08) original GLD geometry

GLD' (v4) ~average of GLD & LDC geometry towards ILD

j4LDC (v4) Jupiter framework description of LDC geometry

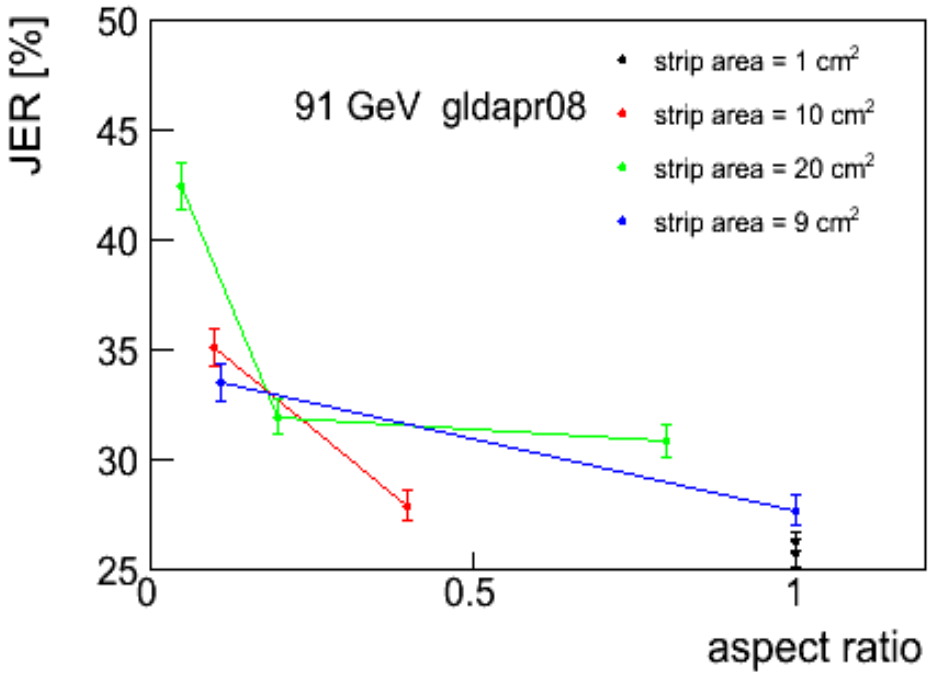
scintillator/tungsten ECAL, scintillator/Fe HCAL

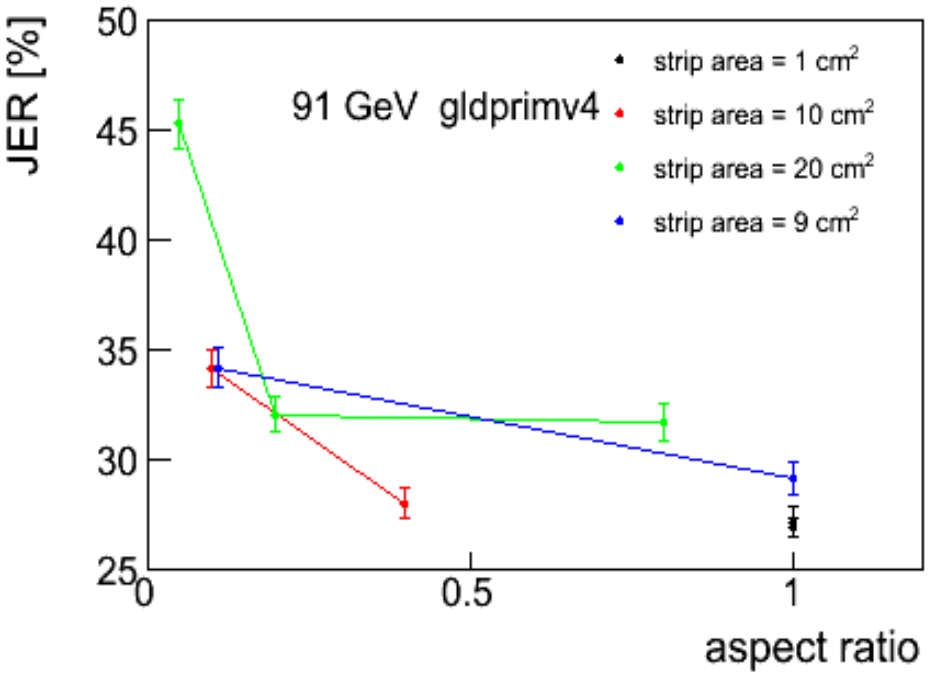
measure PFA performance vs. strip geometry

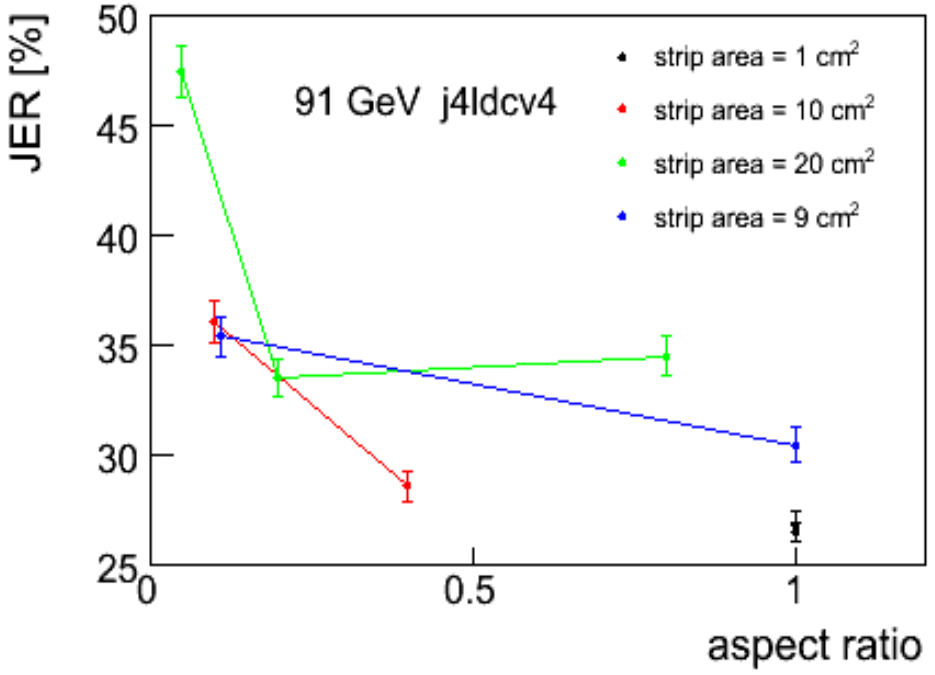
independently vary ECAL and HCAL granularity

for technical reasons, constrained to n*m cm^2 with integer n,m

Very preliminary!!!







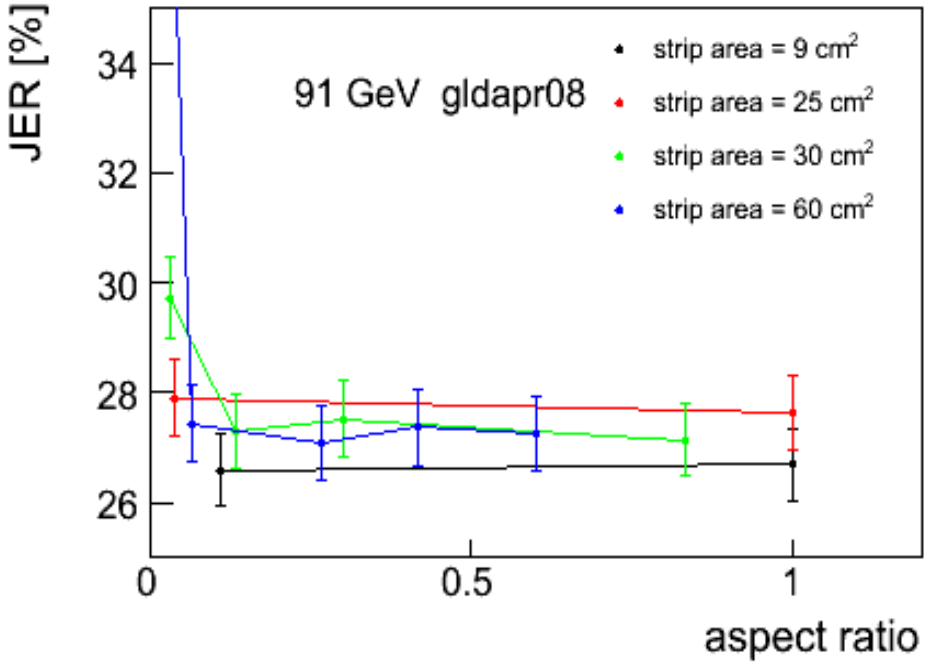
Aspect ratio = strip width/length

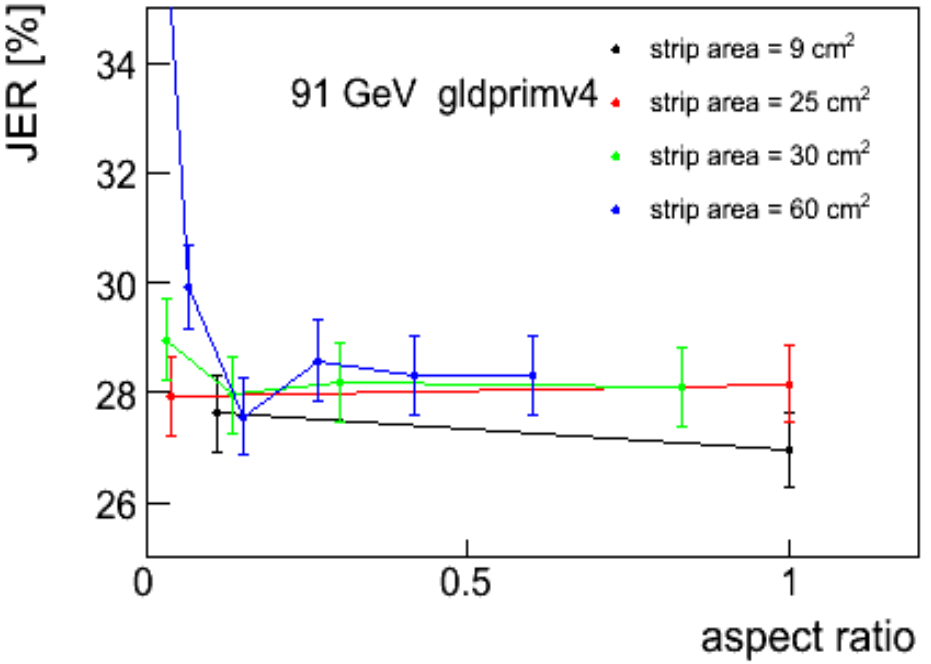
91 GeV qq events
central jets
same events at each point

vary ECAL segmentation
HCAL fixed to 5x5cm^2 tiles

RMS90/E = JER/Sqrt(E)

Very preliminary!!!





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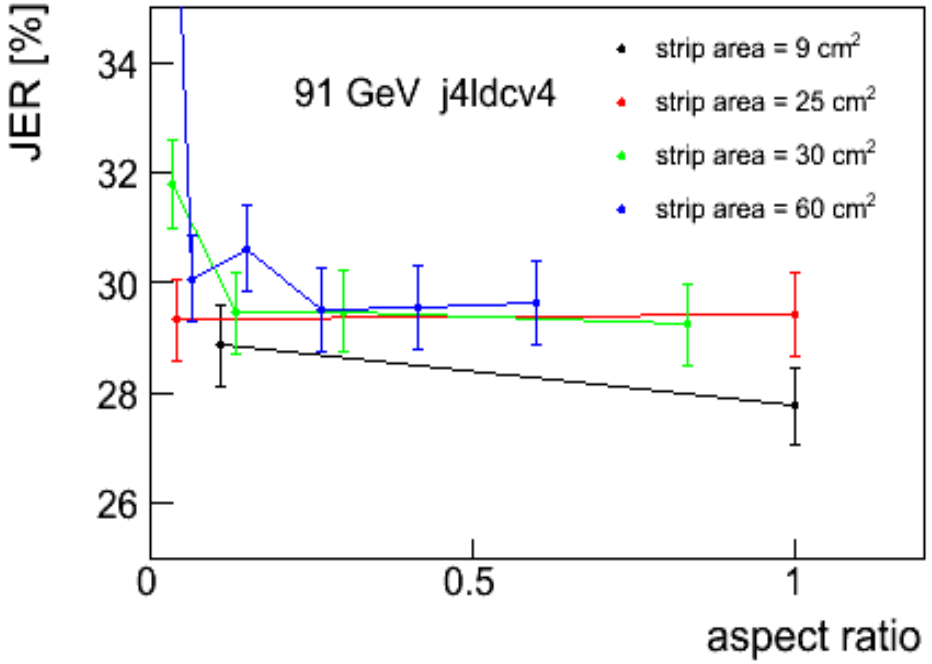
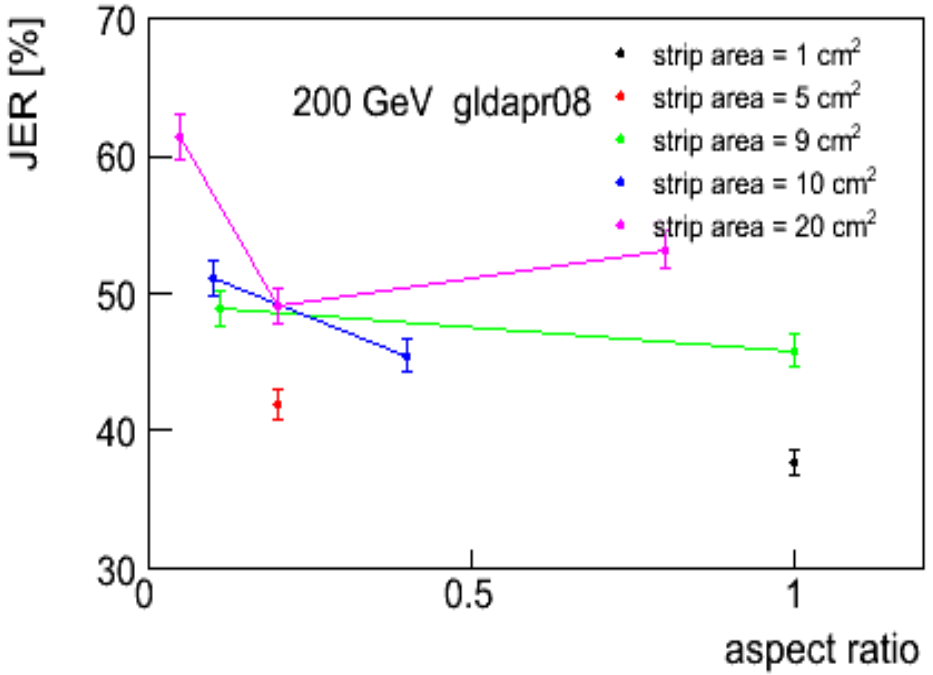


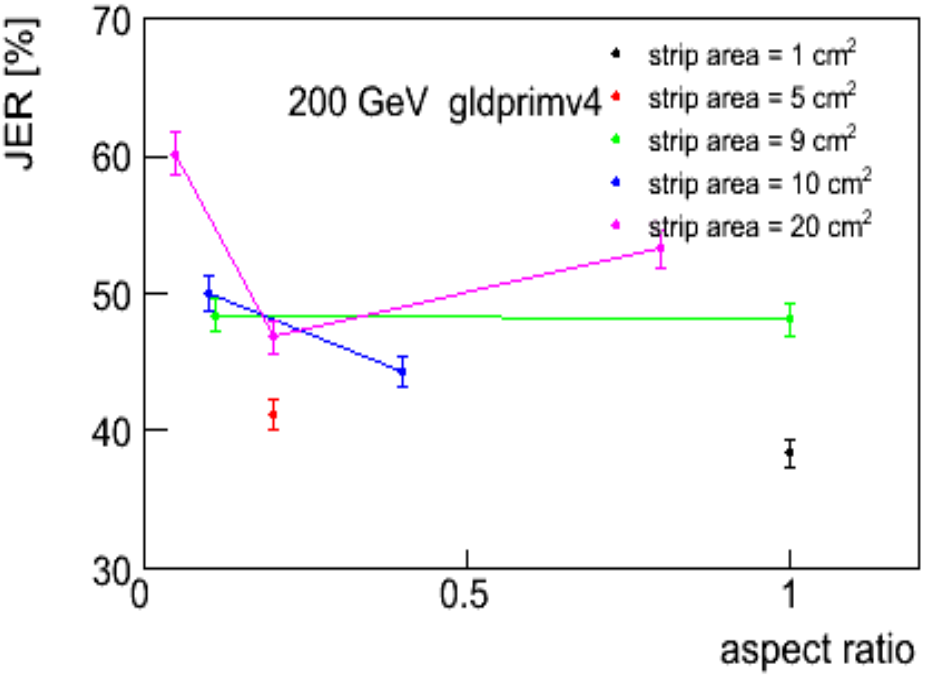
91 GeV qq events
central jets

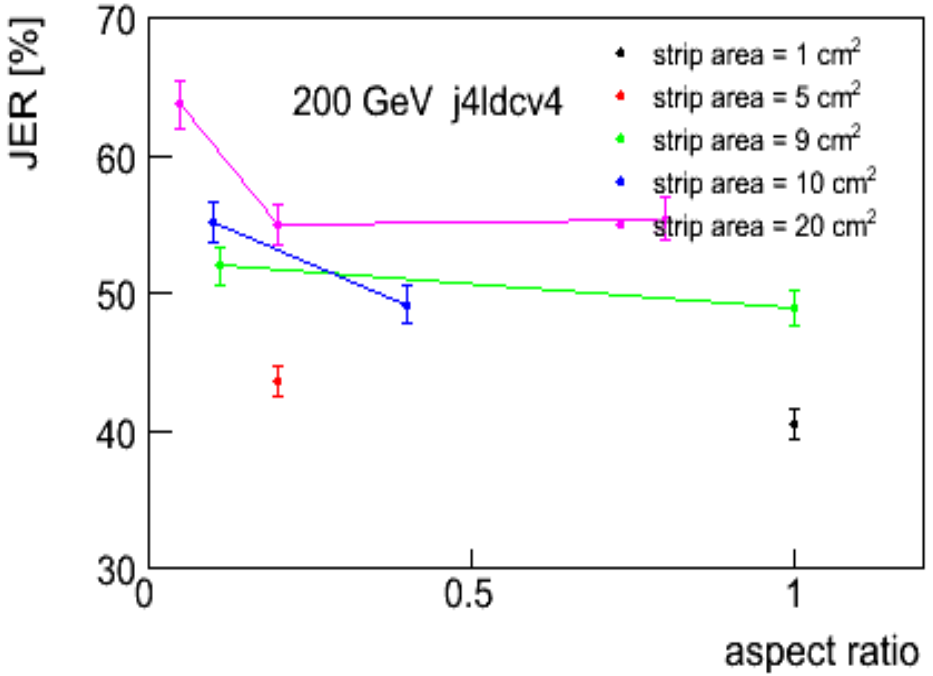
vary HCAL segmentation
ECAL fixed to 1x4cm^2 strips

no strong dependence seen

Very preliminary!!!





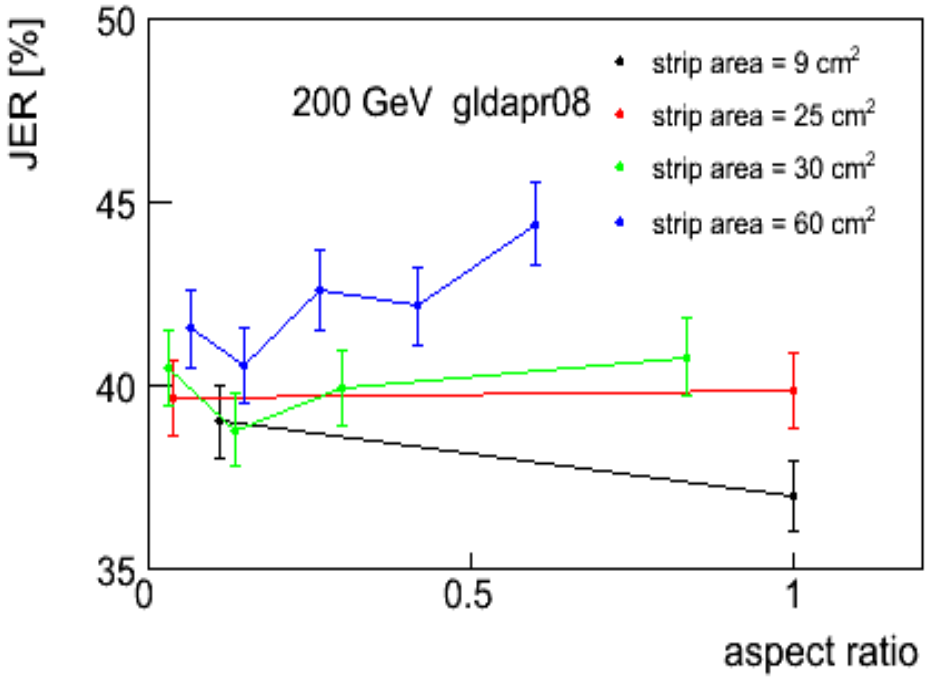


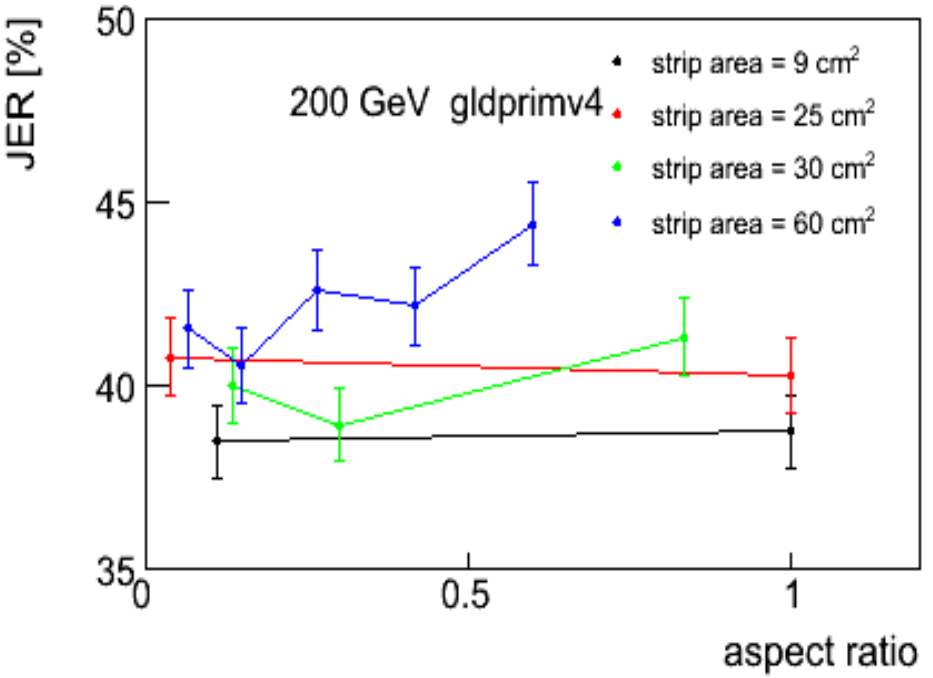
Aspect ratio = strip width/length

200 GeV qq events
central jets

vary ECAL segmentation
HCAL fixed to 5x5cm^2 tiles

Very preliminary!!!





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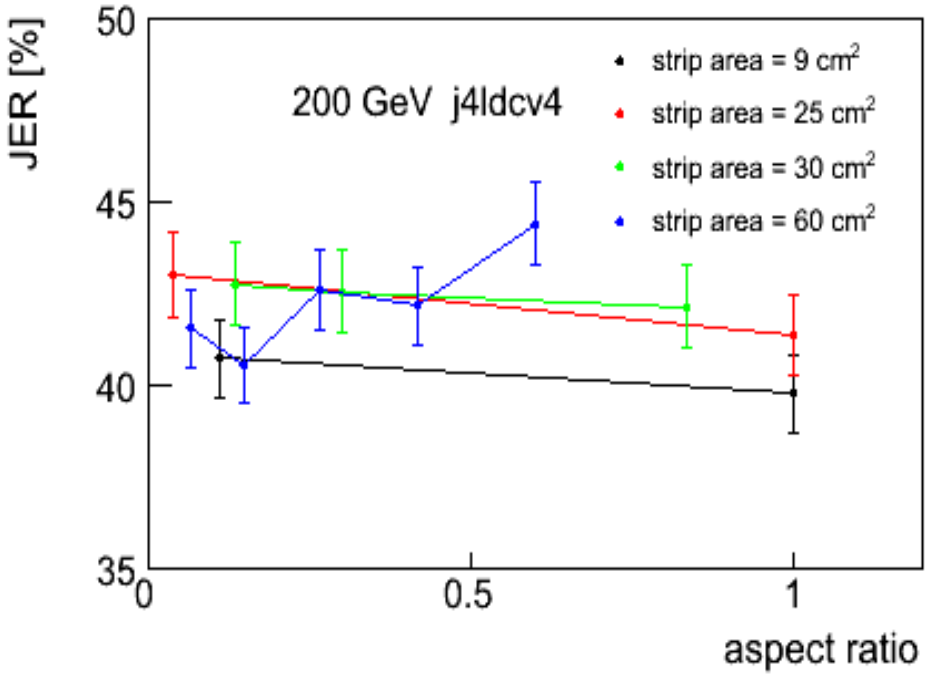

200 GeV qq events
central jets

vary HCAL segmentation
ECAL fixed to 1x4cm^2 strips

start to see some advantages
of strip geometry

Summary

first rough & ready combination of strip clustering & PandoraPFA
- track seeding still to be implemented
- efficiency, elegance of implementation should be improved!

applied to qq events at 91, 200 GeV
- looks like some optimisation will be possible
- too early to draw firm conclusions